



AN EARLY WARNING SYSTEM FOR COASTAL MARINE INVASIVE SPECIES

FY02—Hawaiian Pilot Project

by

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National Ocean Service with other agency and NGO Partners

What are Exotic/Invasive Species?

- ⌚ An “**exotic**” is a species non-native or alien to an ecosystem that has become established (i.e., a reproducing population)
- ⌚ An exotic whose introduction causes or is likely to cause economic, environmental, or human harm is an “**invasive**”

What is the scale of the problem?

Wild guesses abound; marine exotics least known

- ~10-15% of exotics become established
- Estimated 50,000 exotics in US
- Invasive species cost US \$138 M/yr
- Exotics impact 35-46% of endangered species
- Invasive plants infest 100 M acres, impact up to 4,600 ac/day in US West
- US and Canada spend \$14M/year on sea lamprey control
- Invasive West Nile virus in 12 eastern states and D.C.

San Francisco Bay Exotic Species

∞ **175 recorded species of introduced marine invertebrates, fish, algae and higher plants now live in San Francisco Bay**



Introduced in 2000, \$2.3M has already been spent by State and federal agencies to rid California coastal waters of *Caulerpa taxifolia*.

Great Lakes Exotics Problem

∞ 145 exotic species recorded in Great Lakes



Photo: Great Lakes Sea Grant



Photo: US Fish & Wldf. Serv.

One of these, the zebra mussel, *Dreissena polymorpha*, has had huge economic and ecological impacts and now infests 38 States and the District of Columbia

Gulf of Mexico Exotics Problem

Ω 50 exotic species recorded in US nearshore Gulf waters



In 2000, a new stinging invasive jellyfish, *Phyllorhiza punctata*, appeared in eastern Gulf waters, with high densities of medusae (as large as 70 cm in diameter)

Chesapeake Bay Exotics Problem

∞ 45+ exotic species recorded in the Bay



Native to the Gulf of Mexico and eastern Florida, the parasitic barnacle, *Loxothylacus panopaei*, is an invader to the Chesapeake Bay that infects multiple species of xanthid crabs.

Aquaculture , an Exotics Problem

Huge numbers of aquaculture species escape each year.



One example, last year 100,000 salmon escaped from fish pens. Now an outbreak of infectious salmon anemia (ISA) is devastating the Northeast salmon farming industry and wild fish test positive for ISA.

⌚ **Aquaculture of exotic fish, shellfish, and algae may also introduce exotic viral and bacterial diseases**

⌚ **All species under culture in US coastal waters need to be identified**

Program Mission

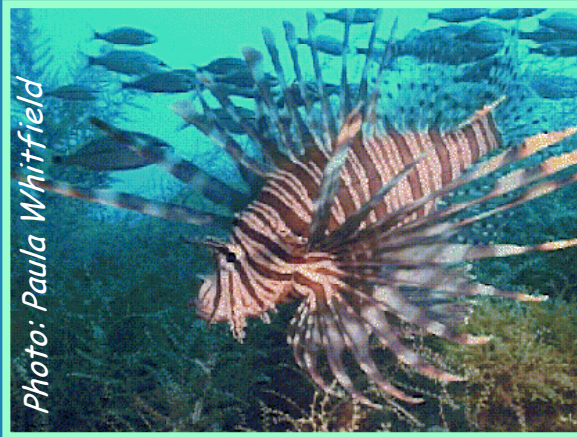
∞ **Provide managers and scientists the ability to assess the risk of coastal exotic species becoming invasive, impacting native wildlife, natural ecosystems, economics, and human health**

One of many US invasives for which the proposed Early Warning System is too late, the European green crab, *Carcinus meanas*, arrived in 1817 and continues to wreak havoc on East and West Coast native species.



Photo: Smithsonian Env. Res. Center

Program Objectives



With a functional Early Warning System for Coastal Invasive Species, the appearance of this venomous, exotic lionfish, *Pterois volitans*, off Florida in the mid-1990s would have been reported, risks predicted, and control measures probably undertaken.

- ❧ **Identify the occurrence of exotic species as early as possible**
- ❧ **Quantify the possible risk of exotic species becoming invasive**

What products will result?

A Website and Early Warning System for Coastal Marine Invasive Species ➡



West Coast exotic, *Polydora ligni*, can bury oysters in inches of mud tubes

- On-site registration
- Facilitated reporting
- Automatic alerts for exotic/invasive species
- Information on invasives and their control
- GIS maps for managers
- Ecological forecasts from risk assessments

How will it be implemented?

∞ The 2002 products will be: a prototype Website, and an Early Warning System for Hawaiian Coastal Invasive Species



Invasive red algae, *Kappaphycus* spp., introduced to Kaneohe Bay, HI are now outcompeting native coral species

∞ Regional modules will be added to the prototype through time to create a National Early Warning System



Why begin with Hawaii?

- ∞ **More invasives than natives; 300+ are coastal**
- ∞ **Data agreement: NCDDC with NMFS Honolulu Lab**
- ∞ **Invasives impact endangered, endemic species**



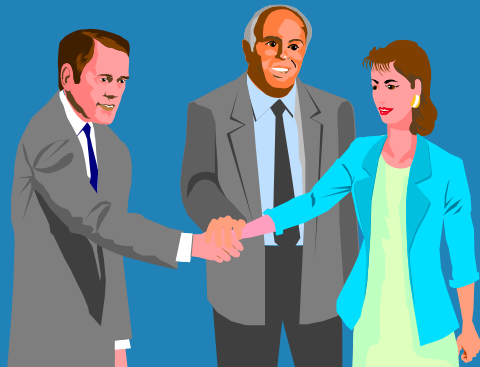
Exotic species are not yet a significant problem for Northwest Hawaiian Island species or the habitats on which they depend. Managers, however, are concerned that invasives can "tip the scale" for saving rare and endangered species like the Hawaiian monk seal, *Monachus schauinslandi*, and the masked angelfish, *Genicanthus personatus*.

Who are partners for the HI Pilot?

- ❧ **NOAA NESDIS /NCDDC**
- ❧ **NOAA National Marine Fisheries Service**
- ❧ **NOAA NOS other offices**
- ❧ **NOAA Oceanic and Atmospheric Research**
- ❧ **US Geological Survey**
- ❧ **US Fish and Wildlife Service**
- ❧ **State of Hawaii Dept. Aquatic Resources**
- ❧ **Bishop Museum**
- ❧ **University of Hawaii**
- ❧ **Smithsonian Museum**
- ❧ **Oceanic Society**
- ❧ **American Fisheries Society**
- ❧ **Other NGOs expected**

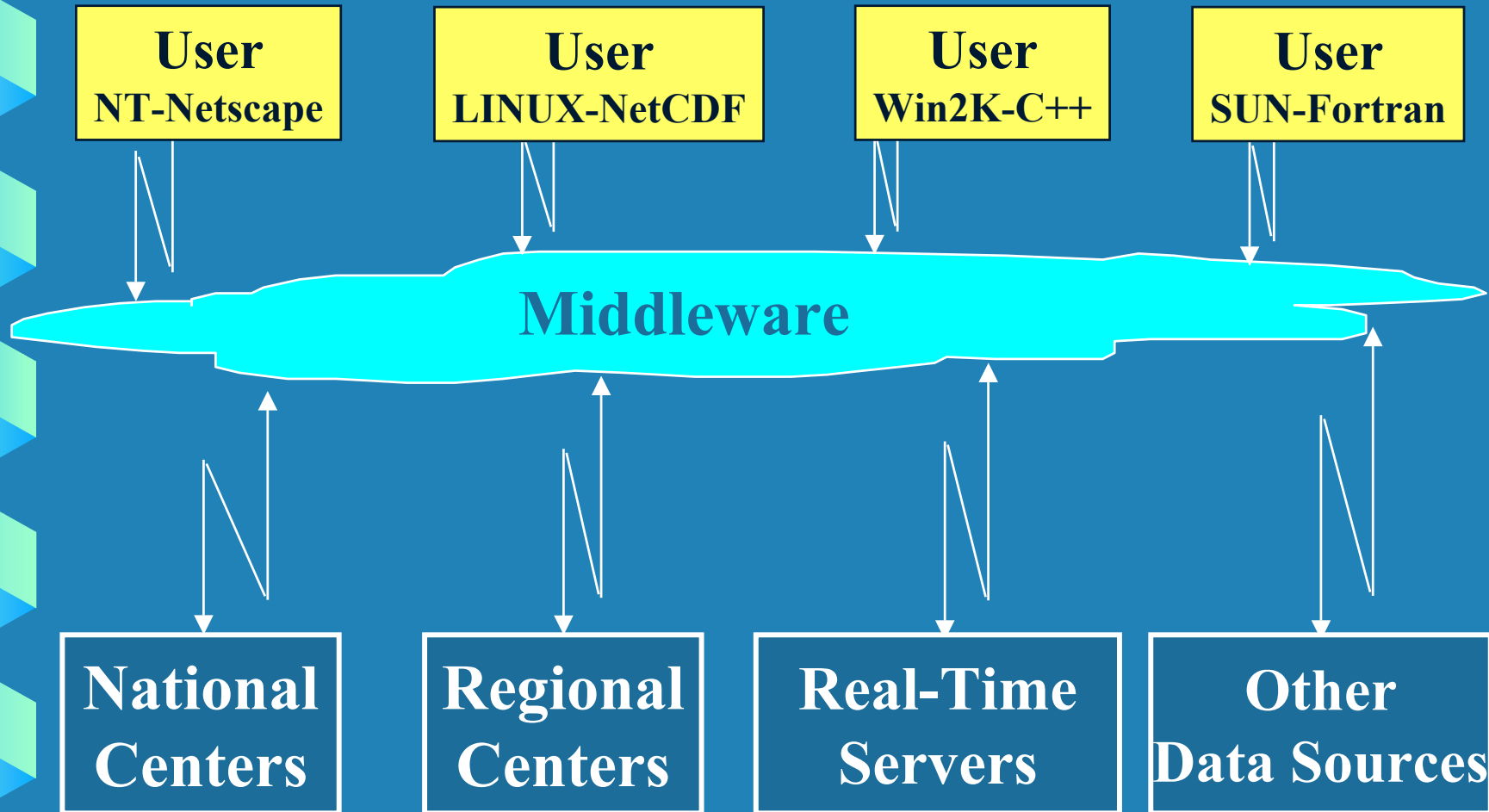
What are the data complications?

- There will not be consensus on hardware platforms;
- There will not be consensus on operating systems;
- There will not be consensus on network protocols;
- There will not be consensus on data formats.

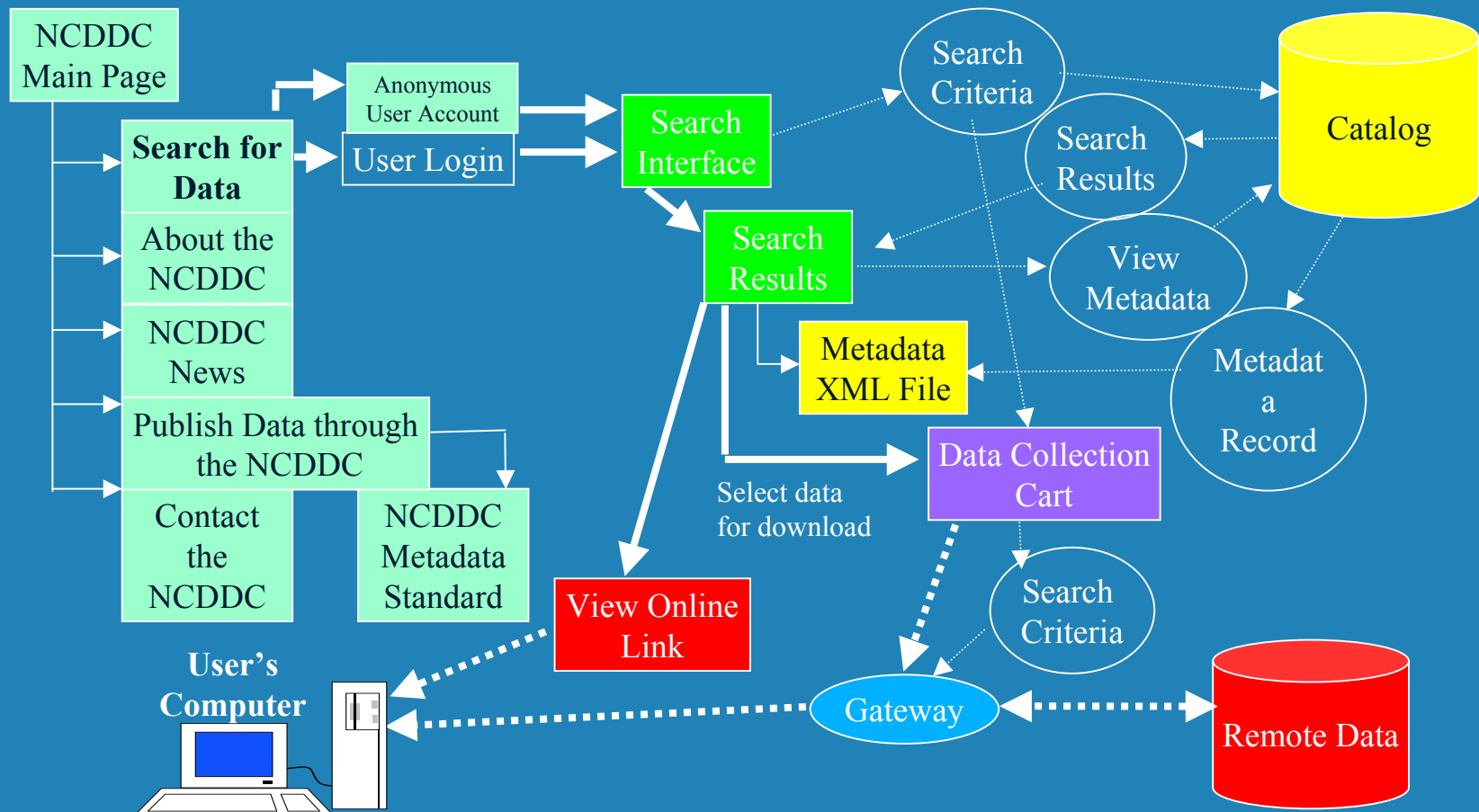


There *must* be consensus on interoperability and an infrastructure to support it.

What is the fundamental system?



How would the system work?



What is the project timeline?

The Hawaiian Pilot Project is expected to be tested by late FY02; additional modules projected for FY03, FY04, and FY05

